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THE BRIGHT YOUNG MEN OF 1958 (12 pp)

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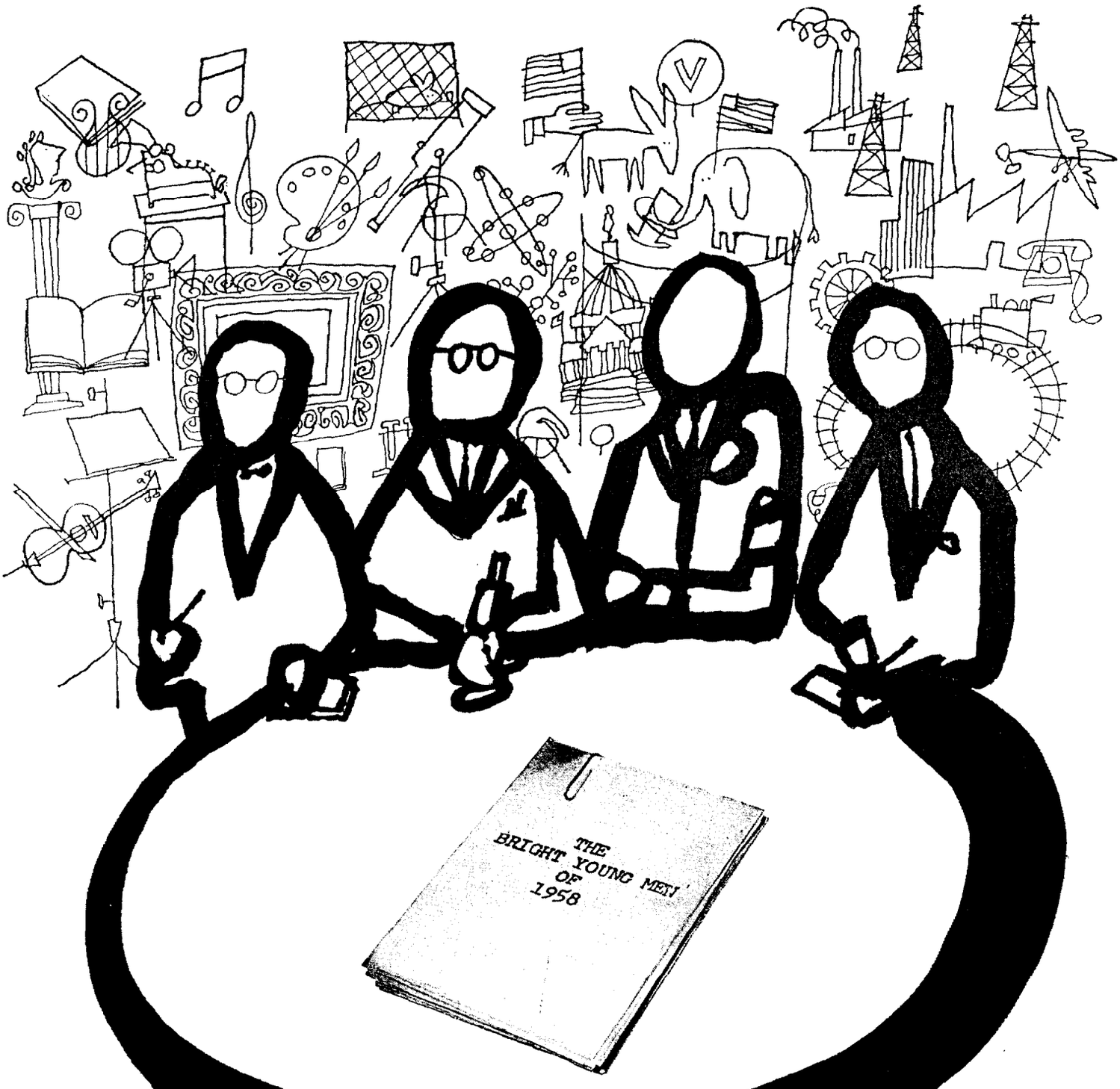

Never before in America's past has the present seemed quite so close to the future. This is a catalytic age; new developments in science, government, business and the arts tumble one after the other, inter-act and change so swiftly that few men are aware that the things we see, touch, hear and think are, for the most part, obsolete. And if the change is a dramatic one, at the heart of this change lies a crisis in leadership. Who are the brightest young men of 1958, the potential leaders of tomorrow? What have they accomplished, what are they seeking—and where are they taking us? To answer these questions, Esquire asked Dr. Paul Klopsteg, Senator Paul Douglas, critic Dwight Macdonald, and businessman Robert Weaver to search their fields for the most outstanding men under 36. On the following pages are the results of that search, 52 young men (and two women) whose achievements and ambitions may forecast, more accurately than the dreams of George Orwell, the true nature of the year 1984.

Charmatz

THE BRIGHT YOUNG MEN IN SCIENCE

by DR. PAUL KLOPSTEG

President-elect of the American Association for the Advancement of Science

To the casual observer, science means machinery, skyscrapers, atom bombs, space missiles, lifesaving drugs. The practical man may know these wonders are not magic, but rather applications of the fundamental principles of nature. He's for finding more of them—they might come in handy someday—but if he is not steeped in science he may think it a bit queer that scientists should pursue them for their own sake.

It is too bad. The small group of young men working in basic research are potentially the most influential men alive. The technology of our great-grandchildren and their concepts of the physical world, including themselves, will emerge from what these men are doing now. Yet most of them are unknown to newspaper readers.

There are reasons. The techniques of science are becoming so specialized and so much work is going on that scientists may be laymen even in their own fields. Frequently they are no help in extra-scientific affairs. Their motivations, their methods, their tempo, their very intensity, even their social habits set them apart. For long stretches at a time their work may seem dull. The boundaries of knowledge yield slowly. From the outside, their successes sometimes look trivial, or they may be impossible to understand.

Occasionally, however, an exciting variation occurs in the usual pattern when a major advance—sometimes referred to as a "breakthrough"—is made on the frontiers of ignorance. Such flashes of genius are a most important ingredient of exceptional practical progress. Always they are shining intellectual achievements.

Can we identify genius in science, find the young scientists who have already made important contributions and are brilliant minds to watch? It would be quite impossible, of course, to predict who will make scientific history in the next twenty-five years. No one can tell who will find something as yet unknown. No scientist is competent to judge the work of men outside his field. I asked several outstanding leaders in each field to identify the men under 36 whom they regard as most promising in their areas. As though by design, the same names turned up again and again. What's more, the work of these young men tended to define the frontiers of their research *inside the atom.*

Theoretical physicists regard the new bombs as disturbing, but scientifically irrelevant, applications of a principle established many years ago about the inner workings of the atom. They are excited about the speed with which new theories are being tested to account for the mysterious forces which hold the nucleus of the atom together.

The nucleus is itself a collection of particles which don't hold together by the usual pull of gravity. If they are all positively charged, they should push away from each other. The big accelerators which tear atoms apart show that there must be much more powerful forces which work across the infinitesimally short distances inside the nucleus. To see how these forces might work, theoretical physicists devise models which their experimental friends can test in the cyclotron.

Much as the planet Uranus was predicted from the observed irregularities of motions of other planets, new particles are predicted to explain the ones we've "seen" so far. The predicted particles frequently do show up, but sometimes still newer ones come along which were not predicted by the model. Current models of the nucleus populate it with mesons, pions, neutrinos, lambdas, sigmas, and many other shifty newcomers constantly darting in and out of other nucleons.

Many model designers and testers are enthusiastic youngsters. A good example is 29-year-old Murray Gell-Mann, associate professor of physics at the California Institue of Technology. Gell-Mann says high-school physics bored him, but his father, a language teacher, assured him it became interesting later on. He discovered the challenge of physics for himself at Yale, graduating at 19 and winning his Ph.D. at M.I.T. two years later. On a trip to Europe at 23 he hit on a scheme for bringing order out of the muddle of strange new particles which is proving as useful as the Mendeleyef table of chemical elements. Because physicists themselves call the particles strange, he christened the system "The Strangeness Theory." He has predicted discovery of some new ones. At Caltech, he and 40-year-old Richard Feynman try out ideas on each other in exuberant blackboard sessions relieved by paperclip flipping.

Last year the Nobel Prize in physics went to two physicists who initiated experiments that proved that the supposedly universal law of parity conservation doesn't always hold in the strange new world of nuclear particles. Tsung-Dao Lee, 31, and Chen Ning Yang, 36 this month, were both born and brought up in China. Son of a professor of mathematics, Yang came to the United States for graduate study on a scholarship provided by the indemnity the U.S. exacted from China for the Boxer Rebellion of 1900 and returned to China for educational purposes. Son of a Shanghai businessman and grandson of a Chinese Episcopalian minister, Lee came here at 19 on a Chinese government scholarship.

The fellow countrymen met at the University of Chicago, where Enrico Fermi and Edward Teller were teaching. Yang went on to work at the Institute for Advanced Study in Princeton, which Einstein and Oppenheimer have made famous, Lee to the physics department of Columbia University. Both married Chinese girls they met here.

The two are great friends and they often talked physics. Like physicists all over the world, they were talking in 1956 about the puzzling behavior of a subatomic particle which upset deep-rooted concepts that were thought to be well established.

Here is how Dr. Yang himself corrected my effort to explain what they did:

"One of these concepts, that of the symmetry between right and left for all physical phenomena, was regarded as very solidly proved, and was called by the physicists the law of parity conservation. Lee and Yang observed that an explanation of the puzzling behavior of the meson would come about very naturally if this law of right-left symmetry should be violated. They then launched a penetrating examination and came to the startling conclusion that, although universally accepted, this law did not have a solid basis.

"A number of crucial experiments to test the law of parity conservation were suggested by Lee and Yang in their work.

"The first such experiment was performed by Dr. Chien Shiung Wu (one of the comparatively few women physicists in the world) of the Columbia University Physics Department, together with Dale D. Hippes and Drs. Ernest Ambler, Raymond W. Hayward, and Ralph P. Hudson of the National Bureau of Standards in Washington. The experiment was very difficult. But what was more discouraging to the experimental group was the fact that few if any physicists really believed in Lee and Yang's suggestion that the well-beloved law of right-left symmetry could be violated. The betting odds at that time were fifty to one against any violation of the law. In face of these heavy odds the experimental group persisted, sustained by their conviction that the scientific spirit of inquiry should come before every other consideration.

"Their persistence was amply repaid when in January, 1957, their experiment came to the dramatic conclusion that the law of right-left symmetry was completely disobeyed in a class of subatomic phenomena. Rapidly, in succession, physicists all over the world performed the other experiments suggested by Lee and Yang and in each case the law of right-left symmetry was found to be violated."

To everybody's surprise Lee and Yang shared the Nobel Prize in

1957. Nobel recognition had never followed a basic discovery so fast. Their insight is not going to change everyday affairs on this planet, but it is an intellectual landmark in our effort to conceive the world beyond our immediate experience.

Outside the galaxy

Astronomers discovered nuclear forces in studying the intense heat of stars. Now advances in physics are helping astronomers piece together a new chemical and physical history of the universe. Thirty-two-year-old Allan Rex Sandage is one of a team of twelve astronomers who are gathering and interpreting evidence of galaxies millions of light years away at the Mt. Wilson and Palomar Observatories in California. Each gets a six-night turn "on the mountain" and spends the rest of the month analyzing his data in the valley.

Dr. Sandage, son of a teacher of business administration at Miami University in Ohio, read science fiction as a boy and decided for a career in astronomy when he first looked through a playmate's little telescope. Today he insists that the modern 200-inch telescope is the real hero of current astronomy; he has been working with it seven of its nine years of existence. From 1951 to 1953 he measured the red shift in the spectra which confirm that the distant galaxies we "see" as they were a billion years ago are moving away from us faster than those nearer us in time and space. This fact suggests that the universe is a finite closed system which is expanding more slowly than it used to do. Dr. Sandage is now reconstructing the life history of individual stars.

Inside the cell

What is different about self-reproducing matter or life? Biologists have a new clue. In the last few years they have isolated the templates inside every cell which keep living material organized in its own pattern. One of these templates is desoxyribonucleic acid—DNA.

Six years ago, when he was only twenty-four, Chicago-born James D. Watson and the English physicist F. H. C. Crick worked out a model of the long, string-like DNA molecule in the Cavendish Laboratory at Cambridge, England. They suggested that it acted as if it were two identical strings wound around each other. Unwind the strings, and each might assemble just the group of atoms needed to grow a new partner. Now assistant professor of biology at Harvard, Dr. Watson is trying to correlate the structure of the DNA molecule with its biological role as the key genetic material.

Thirty-three-year-old Joshua Lederberg, newly appointed chairman of the newly created (1957) department of medical genetics at the University of Wisconsin, has helped throw light on the marvelous evolutionary device by which genes are combined from two parents to produce a slightly differing individual. In graduate school at Yale he started working on bacteria, the single-celled organisms which reproduce by the simple process of splitting. When Lederberg and his team mixed different strains of bacteria together they got one in a million offspring with characteristics of both, just as if they had had two parents instead of one.

Further studies of bacteria at the University of Wisconsin convinced Lederberg that bacteria have genes strung along chromosomes just like higher forms of life. Some bacteria seem to be "males" who can change characteristics of "females." Under the microscope he saw those with "male" characteristics approach the females; the males, with part of the DNA molecule of which chromosomes are made, penetrate the females. This "conjugation" takes half an hour. When the female partner later divides, the two new bacteria share equally the genetic material. Lederberg's discovery of sex in bacteria gives geneticists a perfect laboratory organism. Bacteria are simple, compact, cheap, prolific, and a new generation is produced every twenty minutes.

Inside the molecule

As biologists follow the trail of life deep into the cell, they join forces with the chemists whose province is the molecule. Chemists are doing more of their work on the big, complex molecules of life. Both of the young chemists mentioned by leaders broadly acquainted

1. *Murray Gell-Mann* 2. *Tsung-Dao Lee* 3. *Chen Ning Yang* 4. *Allan R. Sandage* 5. *James D. Watson* 6. *Joshua Lederberg* 7. *Elias J. Corey* 8. *Carl Djerassi* 9. *Frank Press* 10. *John W. Milnor* 11. *Peter D. Lax*

with all the specialties in this field are organic chemists working on the structure of natural products.

Dr. Elias J. Corey, 30-year-old Professor of Chemistry at the University of Illinois, is credited with a "fifth sense" for the brilliantly simple solution of the confusing complications of certain molecules. He cracked the structure of friedelin, a compound in cork and other plants which had baffled analysis for twenty-five years. Solutions such as this fascinate him because they clarify the beautiful molecular relationships among natural products and reveal the fundamental patterns of nature.

Primarily interested in solving tough problems in chemistry and finding new ones, Corey has ranged more widely than most chemists to work on steroids, triterpenes, and theoretical problems in stereochemistry, the spatial architecture of molecules. Stereochemical principles helped Dr. Watson construct a three-dimensional model of the DNA molecule, for instance.

Dr. Corey discovered the sheer fun of solving problems on his own. His father died when he was a baby. He grew up in Methuen, Massachusetts, where he clerked in a grocery store after school and was interested in sports, languages, math, and trying out chemical experiments at home. When he entered M.I.T. the campus was whirling with war research projects and he discovered science as a career. Nowadays, for non-intellectual fun, he plays tennis, swims and climbs mountains with chemist friends. He also finds time to enjoy the luxury of a Mark III (Lincoln) convertible.

Dr. Carl Djerassi, Professor of Chemistry at Wayne State University, in Detroit, is described as "the brilliant youngster of the steroid industry." Born in Vienna in 1923, he came to America before World War II, zipped through Kenyon College and got his Ph.D. in organic chemistry and biochemistry from the University of Wisconsin when he was only 22 years old. Four years later he was in Mexico City directing the fast-moving team of organic chemists at Syntex, S.A., the pharmaceutical concern which synthesizes cortisone and sex hormones from materials in Mexican plants. Although he synthesized many natural compounds of interest to Syntex and developed a class of orally effective steroid hormones such as Norlutin, which is used for treating infertility and menstrual disorders, Djerassi's principal interest is the structure of organic compounds.

A prolific investigator with about two hundred papers to his credit, he has more references in the British Chemical Society's annual roundup than any other American chemist of any age. He's on leave from Wayne this year working with Syntex in Mexico City.

Inside the earth

We cannot see into the heart of the earth, but we can infer a great deal about the lay of the land down there from the travel time of earthquake waves. Brooklyn-born 33-year-old Frank Press worked summers as a Columbia University graduate student in geophysics with a group which set off artificial earthquakes along the Atlantic coastal shelf to find out what kind of rocks were under the ocean floor. He and Dr. Maurice Ewing found evidence that continents don't float around, as earlier supposed, but are firmly planted on a deep layer of old rocks differing from those underlying the oceans and have probably been where they now stand on our maps for a long, long time. He now heads Caltech's Seismological Laboratory, and is one of the young geophysicists who hope to develop important new concepts of the earth, its past and its future.

The poets of science

Mathematicians are the poets of science. Their artistic creations in logic keep the language of science pure. Perhaps because their abstract art does not depend on experience they often achieve early.

Princeton's 27-year-old associate professor of mathematics, John W. Milnor, is an authentic prodigy. Dr. A. W. Tucker, head of the Princeton math department, says Milnor's college teachers didn't feel they ever taught him anything. Five minutes after Milnor walked into Tucker's office as an entering freshman, Tucker was talking to him as if he were a professional colleague. Tucker thinks he must have bored through math texts on his own, because his teachers at Columbia High School in Maplewood, New Jersey, remember him only as a good math student who did all his homework neatly and on time.

Milnor has contributed especially to modern algebraic topology. He startled the 1956 International Topology Conference in Mexico City by presenting a totally new and unforeseen variety of possibilities for differential geometry on a seven-dimensional sphere. He's also interested in game theory which is used by military planners, businessmen, and scientists to determine the best strategy against an opponent—enemy, competitor, or nature herself. The head of mathematics at the Rand Corporation in Santa Monica, California, a research organization working on government contracts, simply handed him a list of their toughest unsolved problems and started getting answers. An ardent mountain climber and skier, Milnor married a Swiss medical student he met in Zurich and now has two sons. This past academic year they were at Oxford where Milnor worked with the nephew of the famous mathematician, A. N. Whitehead. However, they will be back at Princeton for the 1958-59 academic year.

Another mathematical prodigy is 32-year-old Peter D. Lax, whose elegant solutions of classical problems in differential equations are admired for their "light touch." He's developed methods to be used in solving equations in hydrodynamics that could be applied to shock waves developed by rockets. Born in Budapest, where mathematics is highly respected, his parents are physicians who fled with their family to the U.S.; his father has a practice in New York and his mother assists him. Peter taught himself calculus on the boat coming over, entered New York University on the advice of Hungarian scientist friends of the family. When Peter was drafted at 18, Dr. Richard Courant of New York University and others saw to it that the Army assigned him to Los Alamos, where he worked as a "hand computer" and soon as a mathematical analyst. Back at N.Y.U. after the war, he married a pretty girl he met in a graduate course in complex variables and has stayed on at Dr. Courant's Institute of Mathematical Sciences doing research and teaching. His wife, Dr. Anneli Lax, is a mathematician there, too. They have two small children.

The seed of the future

These young men are all driven by a sense of excitement. They feel their disciplines are on the verge of acquiring insights as powerful as those of Einstein. Unlike scientists of a generation ago, they are able to get down to the possible ultimates in physics, in biology, and in chemistry.

As a fair sample of the best in young science, these men can't imagine doing anything but what they're doing. Their motivations are often aesthetic and they speak of the "beauty" of a solution as if it were a painting. They enjoy the challenge of piecing together evidence much as lowbrows enjoy crossword puzzles, but the effort is dignified by their almost religious respect for the logic and order of nature.

If they are sometimes misunderstood, the reason is that their work has recently thrust them into the arena of public affairs where the criteria are not their own. Many of them resent the political pressure for immediate applications to current problems as dangerous to the scientific tradition.

The young men I have mentioned were of an age to be strongly influenced by World War II. They were usually accelerated through college and fired by the stirring scientific mobilization they encountered there. Many joined us because war unsettled their own families abroad. Sadly enough, not one of the native-born scientists mentioned a high-school teacher as an influence. Some simply read books by themselves as youngsters. To these, the fellowship of science they met at college was a revelation, and many started on important work early through association with an outstanding investigator during their graduate-school days. Their record is impressive justification for the investment in grants and fellowships by many institutions and government agencies.

Because they emphasize their work rather than themselves, they may sound unusual. Yet they are unusual only in intellectual ability and intensity of purpose. When they get together to talk shop they chatter away for hours with the enthusiasm of teen-agers planning a party. Two in this group are mountain climbers, others are tennis players, swimmers, bird watchers, hi-fi addicts. Those we have acquired from abroad melt easily into the American pattern of living and playing. The image of the scientist in the popular mind exaggerates their differences. They are simply people who enjoy their work.

It is a good thing they do, for their work is man's most important enterprise. ⋕